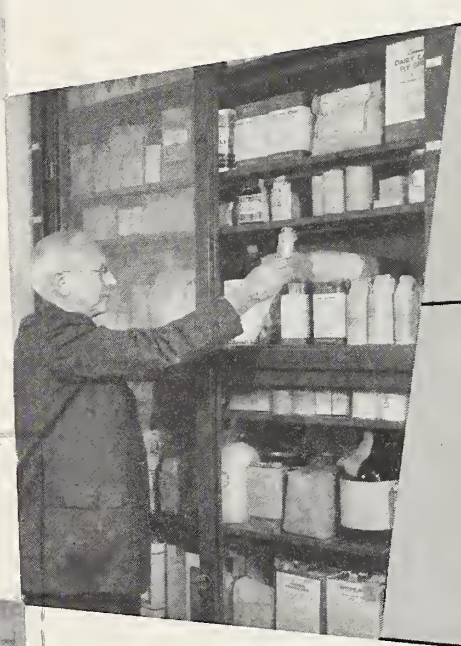
MAY 1955

AGRICULTURAL Research

EFFICIENT

A shift to more efficient bulk milk handling is an important basic change in our dairying

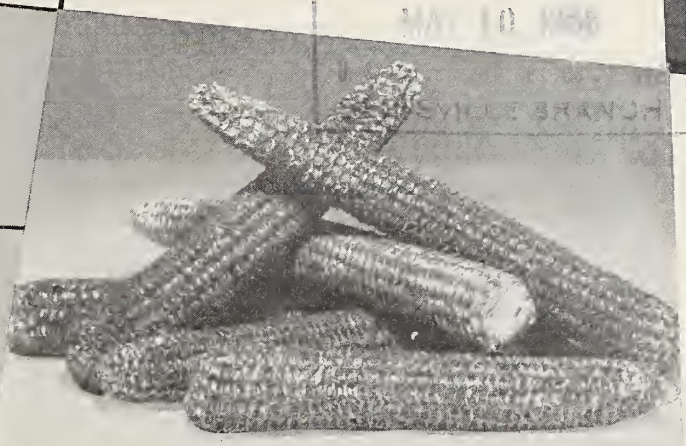
● see page 10



ACCURATE

Labels on our pesticides must be accurate, and a battery of scientists sees that they are

● see page 8



VERSATILE

Research is proving our corncob a versatile material with both farm and industrial uses

● see page 6

UNITED STATES DEPARTMENT OF AGRICULTURE

AGRICULTURAL
Research

Vol. 3—May 1955—No. 11
Joseph F. Silbaugh—Managing Editor
John R. Deatherage—Assistant Editor

CONTENTS

Possibilities

What are plants made of?

We've done a lot to develop crops for efficient production. And we've made progress in improving their quality. But we haven't gone very far in finding out *what's inside them.*

We're just beginning to study the chemical composition of crops the way chemists have studied petroleum. It's this approach that enables the industry to make not only gasoline and lubricants but also medicines, detergents, cosmetics, and hundreds of other products from a barrel of oil.

Of course, we've made a good start on exploring the chemical constituents of our crop plants. We have a fair understanding of such major constituents as carbohydrates, proteins, and fats. But *what* carbohydrates? What proteins? What fats? And what about other compounds?

In the last 10 years, new techniques and equipment have begun to help us answer these questions. We can now separate chemical entities once difficult to break down.

We've done more work on the chemical composition of citrus than any other crop. This is in connection with studies to find how to stabilize the flavor, color, and other qualities of the fruits so they don't deteriorate in processing and storage.

As a result, we now know some 150 different chemical constituents in the orange, including several amino acids not previously reported. There are probably another 100 constituents present, but these haven't been separated and identified. This indicates the complexity of the problem.

We've made a beginning in similar research on other crops. For example, we know 100 constituents in alfalfa. Of interest to the livestock industry is the recent discovery that saponins—found in minute amounts in alfalfas, clovers, and other legumes—appear to be one of the causes of bloat. Fortunately, alfalfas differ in saponin content, so we may be able to breed varieties that are low in this constituent.

New uses for crops . . . better ways of processing and storing products . . . help in breeding more useful plants. This is enough to suggest that the opportunities for research—*the possibilities for progress*—are tremendous.

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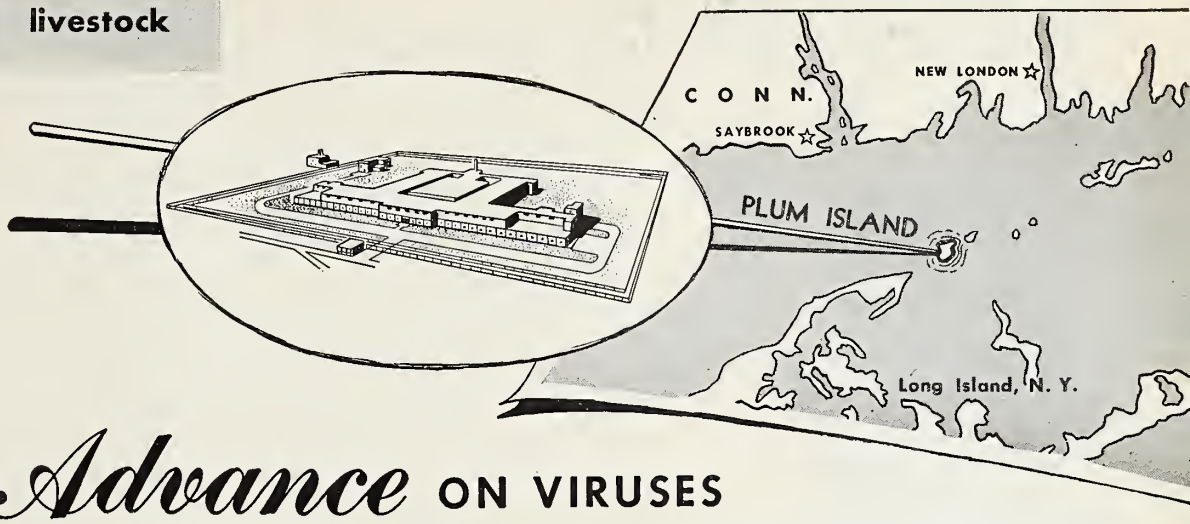
livestock



Advance ON VIRUSES

VS results should aid in fight on VE and foot-and-mouth

SUCCESS in live-tissue culture of the virus that causes vesicular stomatitis (VS) of cattle and swine is reported by scientists of USDA's new Animal Disease Laboratory on Plum Island, N. Y.

This achievement is a valuable contribution to the laboratory's research on virus diseases of livestock, including foot-and-mouth disease.

Plum Island researchers H. L. Bachrach, J. J. Callis, and W. R. Hess have developed a method for growing the vesicular-stomatitis virus on guinea-pig kidney cells. In this procedure, they use the same medium as that in which virus of human polio is cultivated on monkey-kidney cells for production of polio killed-virus vaccine. They succeeded also in growing the VS organism on bovine-tongue tissue, which has been used in Europe as a culture medium for foot-and-mouth virus.

Results of this work are announced in one of the first reports to come from Plum Island since studies of viruses affecting farm animals were begun there by the Agricultural Research Service in July 1954 (AGR. RES., September 1954, p. 10). Tissue culture of the vesicular-stomatitis virus is an advance toward better differential diagnosis and improved control methods, not only for this disease, but possibly also for the more serious viral infections of livestock—foot-and-mouth disease and vesicular exanthema (VE).

Vesicular stomatitis, as a rule, is a relatively minor disease in this country, but on several occasions it has been rather serious in cattle and hogs. VS symptoms—inflamed or blistered mouth, heavy flow of frothy saliva, open sores on tongue and inner part of mouth and at times on udder and feet—are so much like those of foot-and-mouth disease that they seriously complicate and increase the cost of making an accurate diagnosis.

VS, like foot-and-mouth disease, is also hard to distinguish from costly vesicular exanthema (AGR. RES., September 1953, p. 10).

The Plum Island work on procedures for growing vesicular stomatitis virus in live animal tissue is a necessary step toward simpler and more rapid diagnosis of this disease. Also, dependable tissue-culture methods may be needed for production of anti-viral vaccines for livestock. Development of means for large-scale production of VE and foot-and-mouth vaccines could be an invaluable aid in control of these diseases.

Although the foot-and-mouth virus has not struck in this country since 1929, it has invaded both Canada and Mexico in recent years. United States policy in dealing with this costly, swift-moving threat to livestock continues to be one of eradicating the disease by destruction of infected animals and other measures.

Another worthwhile aspect of the work on vesicular stomatitis at Plum Island is that it has served to test the Animal Disease Laboratory's maximum-security measures, designed to insure safety in the conduct of research on viruses. Isolated in Long Island Sound, this laboratory meets the requirement of Federal law that the foot-and-mouth virus can be handled only off the mainland.

Present facilities on Plum Island limit research largely to a single phase of one disease at a time. A new main laboratory, now under construction, will allow fourfold expansion of the current program. It is hoped that full-scale operations can be undertaken by scientists at this new virus-research center by early 1956.☆

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Breeding resistant wheat may be our best defense

AMERICAN farmers and scientists alike are up against a tough foe in the wheat stem sawfly.

While entomologists and plant breeders of Canada and the United States have sought an effective control method, this stem-dwelling pest has become increasingly destructive in North Dakota and Montana. Annual wheat losses in these States amount to about 8 million bushels.

Working at Minot and Fargo, N. Dak., and Choteau and Bozeman, Mont., cooperating USDA and State scientists are conducting several lines of sawfly research. They think their best chance for control lies in development of a resistant wheat.

Canadians, who have fought the sawfly for 20 years, came out with solid-stemmed, sawfly-resisting Rescue variety in 1940. But it lacks adequate resistance to rust and doesn't have yielding and milling qualities United States growers need.

So far, our researchers have checked 9,000 varieties and have found several promising wheats with sawfly resistance equal to that of Rescue or better. The best have been crossed with other varieties to gain resistance to stem rust 15B and other diseases, along with good yielding and milling qualities.

This takes time. An average of 8 years—sometimes 10—are required to produce a commercial variety.

As the tedious testing of strains, making and purifying of crosses, and field-testing moves forward, other research is proving that:

1. Insecticides aren't yet effective because it's hard to reach this insect with spray or dust. The sawfly leaves cover only about 2 weeks a year—as a black-and-yellow, wasplike adult that emerges from stubble in early summer and lays its eggs in growing stems—and this period varies from year to year and field to field. Sprays of some newer organic insecticides have penetrated stems in sufficient amounts to kill larvae, but the heavy doses required make treatment costly and may create a residue problem in the grain. Research on new insecticides, particularly systemics, is continuing.

2. Biological control (use of insect enemies) doesn't look too promising. One sawfly parasite, introduced into Canada from Europe several years ago, now provides 2 to 9 percent control. This insect is being tried in the United States. About 3,000 of a new European import, which parasitizes the sawfly larvae, were released in fields at Minot and Choteau in 1953, but their effectiveness hasn't yet been determined by the scientists.

3. Good cultural practices give some relief. Farmers can cultivate shallow in the fall to expose infected stubble to the sun, then plow deep in the spring to keep adults from emerging. Wheat can be harvested promptly at maturity—before many stems, hollowed up and down and girdled at the base by larvae, fall to the ground. Farmers can rotate wheat with resistant crops, such as oats and some varieties of barley.

The sawfly's versatility adds to the problem. This insect can flourish on both wild and cultivated grasses on any type of soil. It thrives under such diverse climates as those of North Dakota, southern California, and Oregon's wet Willamette Valley, and it's adapted to altitudes ranging from sea level to the Rockies.

The area of major damage, however, is limited. Although the sawfly occurs in at least 14 States west of the Mississippi, it seriously affects yields only in the predominately spring-wheat area in North Dakota and Montana. It hasn't taken hold in the winter-wheat area to the South because wheat matures and dries there before the larvae can complete development (the larvae need moisture with their food). Most of the infestation here is in grasses.

Early-maturing spring wheat varieties might offer some control in North Dakota and Montana, but agronomists say that to shorten the growing season of already short-season crops would sharply cut yields.

Our answer to the wheat stem sawfly lies in research now in progress. But growers can't expect quick results. In many respects, the sawfly problem parallels that of the hessian fly; development of cultural controls and, more recently, resistant varieties have now reduced this long-serious pest to minor importance.☆

Wide-row corn can help some farmers

IT DOES MANY THINGS BUT CALLS FOR ADAPTED EQUIPMENT

WIDE-ROW spacing of corn may meet some definite needs in certain corn-raising areas, cooperative research by USDA and State scientists suggests. But some improvements in farm machinery would help.

Summer seeding of forages in the corn middles eliminates the need for a low-income nurse crop. And when winter wheat follows corn in the rotation, early-fall seeding in the standing corn improves prospects for maximum yield of wheat, for complete maturity of corn, and for better distribution of the fall workload.

Wide-row corn has shown possibilities for the upper Midwest (spring grain area) as a nurse crop for interplanted forages, in tests at the Iowa station. In these tests, forage interplantings in late June or early July generally got a satisfactory start, provided moisture was ample then. And it didn't cut corn yield much. The forage stand was well rooted to hold the soil against the following winter's rains and thaws. And the hay yielded around 1¾ tons the following summer when, under traditional rotations, the forage would just be getting started for the next year's harvest.

Soil scientist W. E. Larson, of ARS, and agronomist F. W. Schaller, of the Iowa experiment station, made these tests at several locations in 1952–54. They found that 80-inch row spacing cut corn yield 20 to 30 percent. To get this good a yield, it's necessary to have at least three-fourths as many plants per acre as is optimum for corn alone in 40-inch rows. That's three-fourths as many plants, *but only half as many* rows for them. Proportionately, wide spacing cuts yield less on the better soils than on poor ones.

In the spring-grain areas, corn-stubble land lies fallow until spring. Usually it is followed by another row crop or by spring oats with a forage interseeded. That way, an entire season is devoted to a low-income crop and to starting a meadow.

Joining corn and hay crops opens several alternatives to a rotation such as corn-corn-oats-meadow-meadow. For example, it could become corn-corn-meadow-meadow, or corn-meadow-meadow, or simply corn-meadow. The latter would work well when the second-year meadow stand is poor, or there's too little legume left.

EARLY-AUGUST STAND of alfalfa, red clover, and timothy in 80-inch middles in a 1953 Iowa experiment. Forage was seeded June 26. Corn at 12,000 plants per acre yielded well.

On better soils in the corn-and-winter-grain areas, early fall seeding of wheat in 60-inch middles has possibilities of improving the seasonal workload and of producing corn of better quality or at lower cost of handling. It wouldn't change crop output materially, either.

In Ohio tests, by researchers G. H. Stringfield, of ARS, and J. L. Haynes, of the Ohio experiment station, 60-inch row spacing actually reduced corn yield only about 3 bushels per acre—but raised the wheat yield an equal amount. Here's how:

When corn is to be followed by wheat, growers ordinarily plant an early-season variety of corn so they can clear the crop off early. With 75-bushel-an-acre land (or better) and the traditional row spacing, growers lose about 6 bushels of corn by using this early variety. And they'll have to harvest before it's fully dry. That means costly drying, possibly some lowering of quality. In the Ohio tests, mid-season or full-season corn in 70-inch rows yielded just 3 bushels per acre less than early corn in 40-inch rows.

Even with early varieties and early harvest of corn, the wheat gets seeded late. But seeding the wheat at the optimum date in the wide middles of standing corn increased test yields 3 bushels per acre.

With some adaptations, it's possible to do necessary operations with existing tractors and implements—4-row corn planters and toolbar cultivators, drills with some disk assemblies removed, rotary mowers. But better-sized implements would help. If engineers succeeded in developing adapted machinery, wide-row farming should have a better chance.☆

CIVILIZING THE CORNCOB

Industry's use of this much-wasted farm residue now amounts to a million tons a year and is growing rapidly

WOODY CENTRAL RING, indicated by T. F. Clark, makes industrial grits for metal cleaning. Crushed cobs (1 inch) are used for litter, mulch. Ground cobs (½ inch) are mixed with molasses, grain, urea, other nutrients for cattle feed. Many cobs go into chemicals.

THE rough-natured corncob, encouraged by research, is leaving the farm in vast numbers these days and going to work in the city. As you might expect, the cob's country-bred toughness is one of the qualities that have helped it win ever-wider acceptance in industrial circles.

More than a million tons of corncobs—returning $10 million to farmers and rural cob grinders—are used yearly in factory operations and industrial products. Such outlets took less than 5,000 tons up to World War II. Since then, largely through USDA and industrial research, use of corncobs has increased sharply—60 percent in the past 5 years.

About half these cobs go into production of the chemical furfural, which is required for making nylon, synthetic rubber, pharmaceuticals, and resins, for petroleum refining, and as an industrial solvent.

The other half-million tons processed every year have a great variety of uses. These include livestock feeding; smoothing, cleaning, and polishing metals, glass, plastics, and molded rubber items; air-blast cleaning of engine parts and large electric-motor and generator installations; serving as a carrier for insecticides and as a constituent of plastics and tread stock for automobile snow tires.

Thousands more tons of cobs—whole or coarsely ground—are used for poultry litter, livestock bedding, garden mulch, and for filling lowlands and preventing erosion. Many farmers do their own grinding, often return crushed cobs to fields to loosen heavy soils and maintain humus.

One of the oldest products is, of course, the famous "Missouri meerschaum," or corncob pipe. Millions are still made, from specially grown cobs, but they account for only a small fraction (possibly 750 tons a year) of all the corncobs now used.

Work at the USDA Northern Regional Research Laboratory, Peoria, Ill., lies behind much of the increase in corncob utilization. ARS scientists and engineers, under the leadership of E. C. Lathrop, have found new uses and—equally important—solved many of the economic and technical problems that hindered industry's development of these uses.

Information the researchers compiled on availability and composition of corncobs has encouraged establishment in the Corn Belt of dozens of collecting stations that ship cobs to furfural plants. This information, along with laboratory studies of grinding methods and equipment and surveys of industrial needs, has helped in setting up 24 major cob-grinding plants and many smaller ones.

Industry has made some use of corncobs since the 1920's—for example, in polishing costume jewelry—but the big increase began during World War II. Large tonnages of cobs went into production of furfural for making synthetic rubber. Also, at the request of the Navy, the Peoria laboratory developed a highly effective method of cleaning aircraft-engine and other machine parts, using a mixture of rice hulls and ground cobs in high-pressure (80 to 90 pounds per square inch) air-blast equipment.

This resulted in huge savings of time in cleaning parts—and lengthened engine life by avoiding wear caused by former cleaning methods. Industrial use of this development is now widespread. The air-blast method was later adapted to low-pressure operation for soft-grit cleaning of large electric motors and generators. It saves 60 to 75 percent of the previous cost of maintaining them.

One of the fastest growing new outlets for ground cobs is in livestock feeds. Both coarsely ground cobs and the chaffy fractions (removed before cobs are ground to finer sizes for industrial use) are mixed with molasses and protein supplements for beef-cattle. Corncobs are the base of many balanced formulas developed to permit more economical feeding.

Research by several State experiment stations shows that ground cobs used in rations for ruminant animals have a nutritive value about 60 percent that of shelled corn. Studies at Peoria indicate that cobs contain substantial amounts of vitamins, found mainly in the chaffy component.

Tests to determine the feed value of chaffy cob fractions compared with the woody components, and to determine the effect of particle size on cob utilization by cattle, are being carried out by the Nebraska experiment station under contract with USDA. A number of other State stations are making tests of their own on use of cobs in cattle rations.

If we develop wider uses for corncobs, there will be plenty. Our total production runs about 15 million tons a year, more than half of it in Iowa, Illinois, Nebraska, Indiana, and Minnesota. Most of this tremendous output is still burned or otherwise disposed of as waste. But research has opened the door to practical, economical collection and utilization of this farm residue, and further expansion of cob uses can be expected.☆

AIR BLASTING by cob grits removes grease and carbon from engine parts 4 to 10 times faster than previous methods—does not mar metal surface or alter critical dimensions.

How ice-water chilling affects chicken flavor

■ MANY POULTRY PROCESSORS immerse their dressed whole chickens in a tank of slush ice or ice water to chill the carcasses in preparation for freezing or refrigerated shipment and storage. Does this practice significantly reduce the flavor quality of the chicken?

Not so you can notice it, say scientists of the USDA Western Regional Research Laboratory, Albany, Calif. ARS chemists E. L. Pippen and A. A. Klose emphasize that prolonged holding of chicken in cold water is detrimental to maintenance of top flavor and should be avoided. But they conclude from recent tests that present commercial methods of slush-ice chilling don't normally result in detectable loss of flavor in chicken that is later fried or roasted.

Previous work (AGR. RES., August 1954, p. 5) showed that *broth* prepared from carcasses chilled in ice water for as little as 5 hours had less flavor than broth from unsoaked carcasses. These tests were made with *half carcasses* that had been frozen and then thawed. Taste-panel judging of flavor was confined to broths prepared from the test carcasses and did not include evaluation of the fried or roasted product.

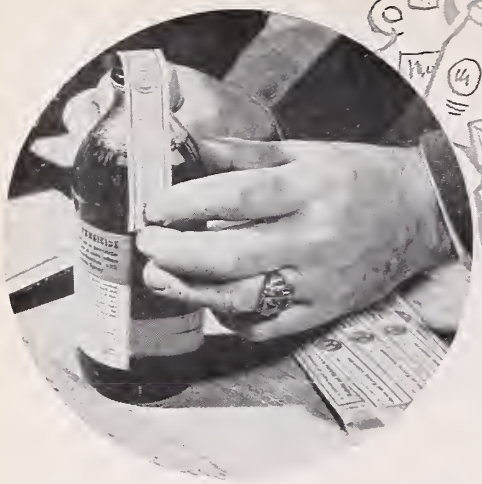
The more recent research includes taste tests of fried and roasted chicken from air-chilled and ice-water-chilled *whole carcasses*. As a check on earlier work with pre-frozen chickens, tests were made with broth from freshly killed, dressed, and drawn half carcasses. This yielded new data on water-soluble flavor ingredients of chicken.

Broth prepared from freshly dressed half carcasses immersed in ice water for as little as 3 hours had noticeably less flavor than broth from air-chilled half carcasses. When the soluble material extracted from water-chilled chickens was recovered (by freeze-drying the ice water) and added to the broth, the lost flavor was restored.

The ability of the ice-water extract to improve broth flavor is probably due to its mineral content (mainly potassium, sodium, and chloride salts). Substitution of table salt (sodium chloride) for the minerals extracted (on an equal-weight basis) restored part of the lost flavor.

Roast chicken prepared from whole or half carcasses chilled for 3 hours in ice water was judged to have virtually as good flavor as roast chicken from air-chilled carcasses. When chilling time was lengthened to 18 hours, however, the taste panel definitely favored roast chicken from the air-chilled product. In experiments with half carcasses, white meat lost its flavor faster in water chilling than dark meat.

Fried chicken from carcasses chilled in ice water *as long as 20 hours* had as good flavor as that prepared from air-chilled birds.☆



ROVING INVESTIGATOR seals a pesticide package chosen from retail shelf. He checks especially for nonregistered items and those registered but suspect or shelf-aged. Sample and evidence of interstate shipment go to ARS laboratory. Product is thoroughly tested.

What's on th

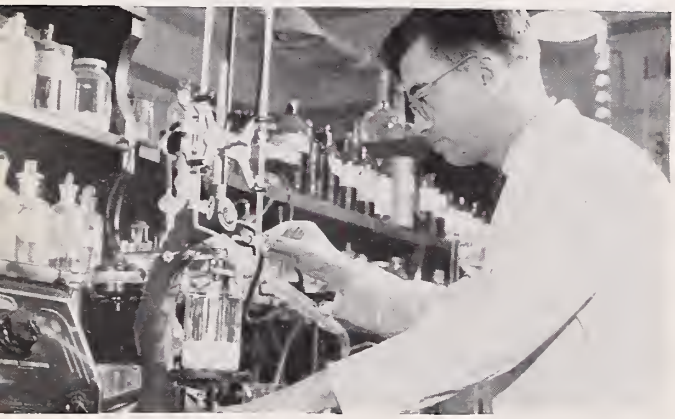
PESTICIDES MUST MEET STRICT STANDARDS FOR REGIS

WHEN YOU BUY one of the 35,000 pesticides now on the market and use it as instructed, there's a good chance you'll get the results claimed.

USDA regulation of interstate trade in such chemicals now protects the public from misinformation, especially where it might increase the hazard to users.

Under the Federal Insecticide, Fungicide, and Rodenticide Act, a manufacturer or distributor must register pesticides (which include weed killers and disinfectants) with the ARS Pesticide Regulation Section before shipping

1 Chemist analyzes sample of an economic poison that is being checked for its composition. Analysis must agree with composition claimed on the label. The analysis will also guide in deciding whether the product is capable of giving results claimed for it by the manufacturer.



2 Germicidal potency of disinfectant is tested by smearing soapstone slo with bacteria, scrubbing with the chemical, wiping surface with a steril cotton swab, and touching the cotton to sterile agar in the tube. If ger micide failed, bacteria, transferred in the cotton, will grow on the aga

5 Insecticide is applied to the skin of a clipped rabbit to test the animal's reaction to it. Tests like this show the pharmacologists any hazard to humans or domestic animals through use of the product. If harmful, the product label must contain an appropriate word of warning.

6 W. E. Ligon, Jr., in charge of the pharmacology laboratory, puts a r into the drawer of an inhalation chamber. He'll spray an insecticide in the chamber. The rat's reaction to inhaling the vapors may show wheth humans, pets, or farm animals may be harmfully affected by breathing the

e label?

ATION BY USDA

them interstate. But to be registered, a product must meet certain standards—be effective for the use stated and to the extent claimed, be properly labeled as to ingredients, and contain adequate directions, including warnings.

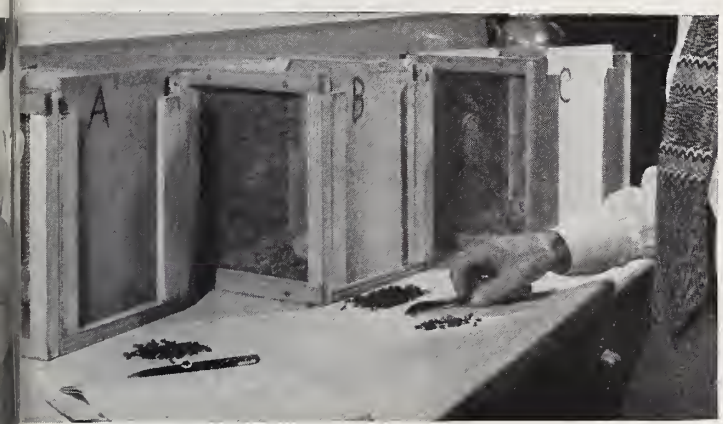
Applicants must support their claims with evidence. It often takes much negotiation to reach an understanding that will permit registering the product. Vigilant against substandard products and false claims, ARS also shows producers how to qualify when products are good. A registered product must continue to meet standards. Roving investigators collect samples from the market for testing (see photos). Most minor violations are corrected when called to the producers' attention. In serious cases, products are seized and offenders may be fined up to $1,000 and imprisoned up to 1 year. Adverse publicity from convictions may be feared even more.

In a typical year, 1,800 products were examined. More than 350 were in violation of the law, 44 of them were seized, and 1 manufacturer was prosecuted.

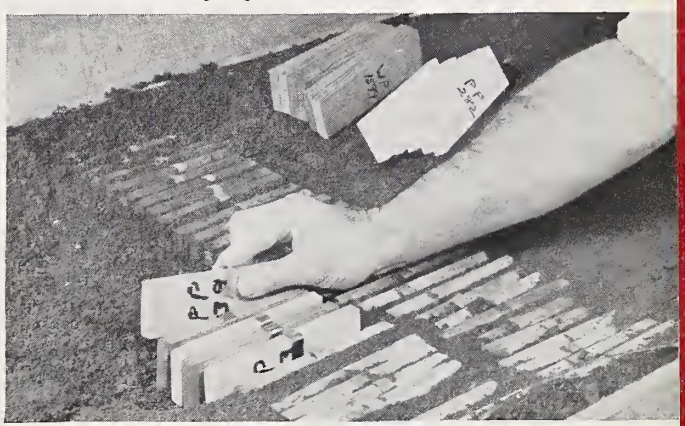
Under the recent Miller Act, the Department of Health, Education, and Welfare sets up tolerances for the amount of a pesticide that may remain on food products. ARS advises whether tolerances requested reasonably reflect the residues likely to result from use, and certifies whether the product is agriculturally useful.

ARS also works closely with State pesticide control officials in seeing that products are legally marketed, with the Federal Trade Commission in preventing extravagant advertising, and with the Public Health Service in setting up adequate safety precautions.☆

3 Scientists check fly kill from contact with insecticide sprayed on board at front of cage. The kill here is compared with that from contact with a standard insecticide. The flies are also exposed to a similar untreated board to make sure that the insecticides alone caused all of the deaths.



4 Blocks treated with various chemical preservatives soon show whether chemicals are effective against destructive fungi. The blocks are buried in damp soil abundant in wood-destroying fungi and kept at temperatures favorable to fungus growth. This is faster than testing outdoors.



7 A flea powder is tested on an infested dog to determine the flea-killing power. Dead fleas drop to floor and are easily visible on white paper there. The dog will be studied carefully for any sign of skin irritation. Animal insecticides must be harmless to the animals and animal products.

8 Air blown over a herbicide and trapped in the bag that encased this tomato plant caused the plant to wilt. This weed killer, like so many, is quite volatile. On warm or windy days its fumes are quite likely to drift some distance and injure tender plants. Label must warn of this.

dairy

TREND IN DAIRYING

Bulk milk

THIS EFFICIENT SYSTEM IS WIDELY USED IN CALIFORNIA AND FLORIDA AND HAS SPREAD TO 28 OTHER STATES

TRADITIONAL 10-gallon milk cans seem destined to give way to farm tanks holding hundreds of gallons, the can-hauling truck to a tanker equipped with pump and hose.

A gradual shiftover to *bulk* milk handling—termed one of the most important basic changes in the history of dairying—has so far been achieved by about 1 commercial dairy farm in 100 in this country.

This estimate comes from a survey by agricultural economists of the Farmer Cooperative Service. The study provides USDA's first information on how far our dairy industry has moved with the bulk system.

Although bulk handling was introduced in California about 15 years ago and has spread widely there and in Florida, it has been launched elsewhere only since 1948. The FCS survey, began in 1953, shows that about half the commercial dairy farms supplying bulk milk are in California and Florida, the rest in 28 other States. National totals showed some 6,200 farms equipped with bulk tanks and shipping direct in 600 tank trucks to 275 plants.

Since the milking herds on farms of bulk shippers in California and Florida average much larger than herds in most other areas, all of the 104 plants studied in the survey are outside these two States.

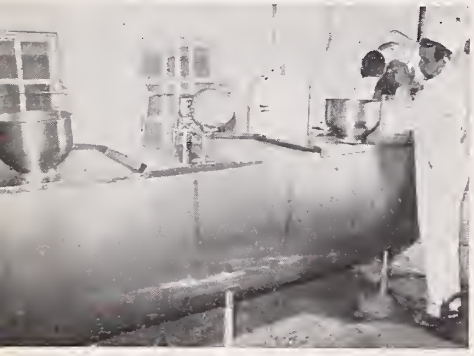
Bulk-handling equipment represents a sizable initial investment to farmers, truckers, or milk-plant operators who launch the new system. But the integrated operation offers advantages to all three groups through reduced costs, lower product losses from handling, higher milk quality, and expanded markets. Consumers may also share in eventual savings—and get better milk as well.

Larger dairy farms can gain most from bulk handling—and they are using it most. Among "graded" milk producers surveyed, bulk shippers' milking herds averaged 40 cows and can shippers' herds only 22 cows. In one peak month, milk volume averaged 1,015 pounds for bulk shippers, 525 pounds for can shippers.

The mechanized bulk system brings many innovations. For example: A dairyman cools milk from 15° to 25° F. lower than before and may conveniently store milk on the farm for several days. Inspection, weight computation, and sampling shift from plant to hauler. The plant washes and sanitizes the hauler's truck tank. Often the plant has to continue receiving milk in cans as well as from farm pick-up tank trucks.

That the system is adaptable to older as well as newer milking methods is shown by the survey. Just over

1 Dairyman pours milk through strainer into farm bulk tank. Milk cools fast, is held at 34°–38° F. Tanks vary from 60 to 1,500 gallons or more; 200, 300, 400 are most used.

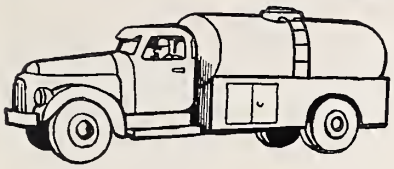


2 Tanker transport makes rounds of farms to pick up milk. Most popular of units is 1,500-gallon tank mounted on straight-frame truck. Others hold 500 to 5,000 gallons.

3 Truck driver takes butterfat sample from a farm bulk tank. He will also sample milk for bacteria count, inspect for appearance, odor, and temperature, measure for volume.

4 Milk is transferred from farm bulk tank to truck tank through the sanitary pump and plastic hose mounted on the truck. Hose is then coiled and truck goes on to next farm.

handling



10 percent of all bulk shippers had milking parlors and pipeline milking systems—bulk handling gave these dairymen a completely integrated modern system. But the great majority had adapted their bulk tanks to conventional stanchion-type barns and machine-bucket milkers.

A price premium for farm tank milk—this premium is not specifically related to quality—was paid producers by 45 percent of the reporting plants. These bonuses ranged from 5 to 25 cents per hundredweight. About 75 percent of the plants reported tank-hauling rates lower, on the average, than can-hauling rates.

Of the 104 plants, 50 received all milk on every-day pickup. Schedules of the other plants included flexible farm-pickup patterns such as every other day, 5 days a week, every third milking, and every third day.

Twenty-six of the plants studied were farmer cooperatives. Some cooperatives and other distributors are now helping farmers finance the high initial investment required for farm bulk-handling equipment.☆

5 At processing plant, truck hose is connected to a pipe in wall and milk is pumped into storage tanks. Washing and sanitizing the truck's tank is part of plant routine.

Oat-pea winter feed suits herds in Plains

■ When winter comes to the Northern Plains, dairy herds get silage of *many* kinds. This variety is due mainly to lack of science-based knowledge about what's *best* for heifers and milk cows here.

Now, from work at the USDA Northern Great Plains Dairy Station, Mandan, N. Dak., comes evidence that Marion oats and Canada field peas, grown together and ensiled, make a superior and convenient winter forage for dairy cattle. This oat-pea diet was supplemented with grass hay for heifers, with grass hay plus a simple concentrate for cows.

Each spring for 4 years, the experimental field was planted to a mixture of 40 pounds of oats and 35 pounds of peas. Good stands were obtained each year. The crop was harvested when the oats were in the soft-dough stage (the peas were usually just starting to form in small pods). Once cut, the feed was quickly ensiled. No preservative was used, but water was added some years to improve moisture content. The silage was estimated 75 to 85 percent oats, 25 to 15 percent peas.

ARS agronomist G. A. Rogler, who assisted in planning these tests and analyzing the results, reports that the oat-pea silage equaled or surpassed corn silage—the feed now generally used. The per-acre yield of oat-pea silage was equal to that of corn during the experiments; but, unlike corn, the oat-pea crop needed no cultivation. Weed control was as good as in corn fields, sometimes better. The mixed crop could be harvested early, and it left a stubble to protect fields from erosion.

Wildrye-sweetclover would make a satisfactory silage for dairy herds in this area if a stand of sweetclover could be maintained, Rogler concludes. In his tests, however, yields of wildrye alone were too low.

Holstein heifers made good gains on all three silages, with the supplements used. But gains were best on oat-pea feed, says dairy husbandman R. F. Gaalaas, who studied effects of the feeds on the heifers' nutrition as well as on milk production of Holstein cows.

Daily gains of heifers on the oat-pea silage averaged about 1⅓ pounds, gains of cows better than ⅓ pound. On the wildrye-sweetclover silage, heifers averaged gains of a little less than a pound, and cows lost just under ¼ pound. In one trial on corn silage, heifers gained slightly more than 1 pound, cows only 4/100 pound.

During 30-day and 40-day trials, milk production on oat-pea silage averaged 32 pounds with 1.09 pounds butterfat, compared to 30.5 pounds of milk and 1.07 pounds of butterfat on the wildrye-sweetclover silage. Oat-pea silage was compared with corn silage in one experimental period, and milk production average ran about the same.

The oat-pea silage, with the supplements used in these tests, seemed better able to provide all the nutrients needed for milk production and body maintenance than corn silage or wildrye-sweetclover.☆

fruits and vegetables

INSECTICIDES and CROP QUALITY

There's still a lot to learn—

growers should follow the recommendations

INSECTICIDES are essential to modern food production. Without these chemicals, wormy apples would be the rule. Fresh fruits and vegetables reaching the market without insect damage would be priced out of reach for most of us.

But can farmers treat their crops and lands with these potent insect-killers without some harmful effect on food flavor, aroma, or texture? Research has disclosed no particular problem when insecticides are used *according to the recommendations.* USDA workers see signs, however, that undesirable effects may develop if growers double recommended treatments "for good measure."

V. R. Boswell, head of ARS vegetable crops research, points out that the detrimental effect of BHC—and, to a lesser degree, that of its pure gamma isomer, lindane—has been established. In addition, he says, there is evidence that both chlordane and toxaphene tend to impair flavor and quality in some fruits and vegetables under certain conditions.

Boswell cites Washington State experiment station research in which normal rates of chlordane (and parathion) lowered the quality of peas and beans. Scientists at the New Jersey station found that soil treatments with 2 to 16 pounds of chlordane per acre and 25 to 50 pounds of toxaphene (the higher rates are considerably above normal) caused definite off-flavor in potatoes. Chlordane also affected potato quality in studies by the Maine station.

Louisiana-grown sweetpotatoes from plots treated with chlordane at 26 pounds per acre were poor-textured and stringy. In similar plots in which plant foliage was repeatedly dusted with heavy applications of 20-percent toxaphene, the sweetpotatoes lacked sweetness and flavor.

It has been difficult—for several reasons—to tie down these findings, Boswell says. Because widespread use of organic insecticides is relatively new, we still have little information on the "accumulative effect" from their buildup in the soil. In addition, soil and weather apparently can alter experimental results, and different plants may vary in their responses to these chemical materials.

BHC is not recommended for use on any food crop, and lindane for only a few. But ARS research has shown that BHC, accumulating in the soil, can *indirectly* impair food quality and flavor. A grower who rotates food with nonfood crops—for example, peanuts with cotton that is BHC treated—may find that his food crop will have an off-flavor.

Pointing out how different soils and weather give different results, Boswell cites cooperative research by ARS and the New Jersey and Washington State experiment stations.

The New Jersey researchers carried out seven thousand quality tests on eight vegetables grown on Sassafras sandy loam. Vegetables from soil treated with higher-than-normal rates of insecticides—DDT at 120 pounds per acre and chlordane at 8, 15, and 75 pounds—were generally downgraded in taste tests, although no single test was significant.

At the Irrigation Experiment Station, Prosser, Wash., there was variable impairment of quality by high rates of DDT or chlordane. Aldrin at 60 pounds per acre (the normal dose is 3 pounds) caused poor flavor in sweet corn and potatoes.

ARS studies at Beltsville, Md., revealed a tendency toward lower quality and flavor in carrots and Stringless Black Valentine beans grown in soils heavily dosed with DDT or TDE. In similar trials, however, aldrin, dieldrin, endrin, isodrin, chlordane, methoxychlor, toxaphene, and dilan had no significant effect on flavor or odor of beans or carrots.

Unless testing methods can be improved so that the effects of factors other than the insecticide can be accurately measured or eliminated, it may take many years to get reliable information on most of the materials now in use. Meanwhile, Boswell advises growers to use these chemicals only when they're needed—and then at the recommended rates.☆

When to IRRIGATE eastern orchards

LOCAL CONDITIONS HOLD THE ANSWER TO THIS DROUGHT-RAISED QUESTION

LAST summer's drought—and 3 successive drought years in some areas—is spurring many eastern orchardists to study the possibilities of sprinkler irrigation.

USDA studies indicate that whether it will pay to install a sprinkler system depends on local conditions. Many factors are involved—type and depth of soil. kinds of fruits and other crops grown, history of drought (frequency and duration), and adequacy and cheapness of water.

Soil is the plants' water reservoir. Consideration of the need for irrigation starts with the soil's water-holding capacity. When a soil is at field capacity (fully saturated but drained of free water), crops can get roughly half of this water. The remainder is held in the soil by surface tension of the soil particles and isn't available to plants, even if they're wilting. Something like that happens when you wring a wet cloth—it's still damp afterward. And we must remember, too, that plants can "wring" from soil only the water that lies within reach of the crop's root system.

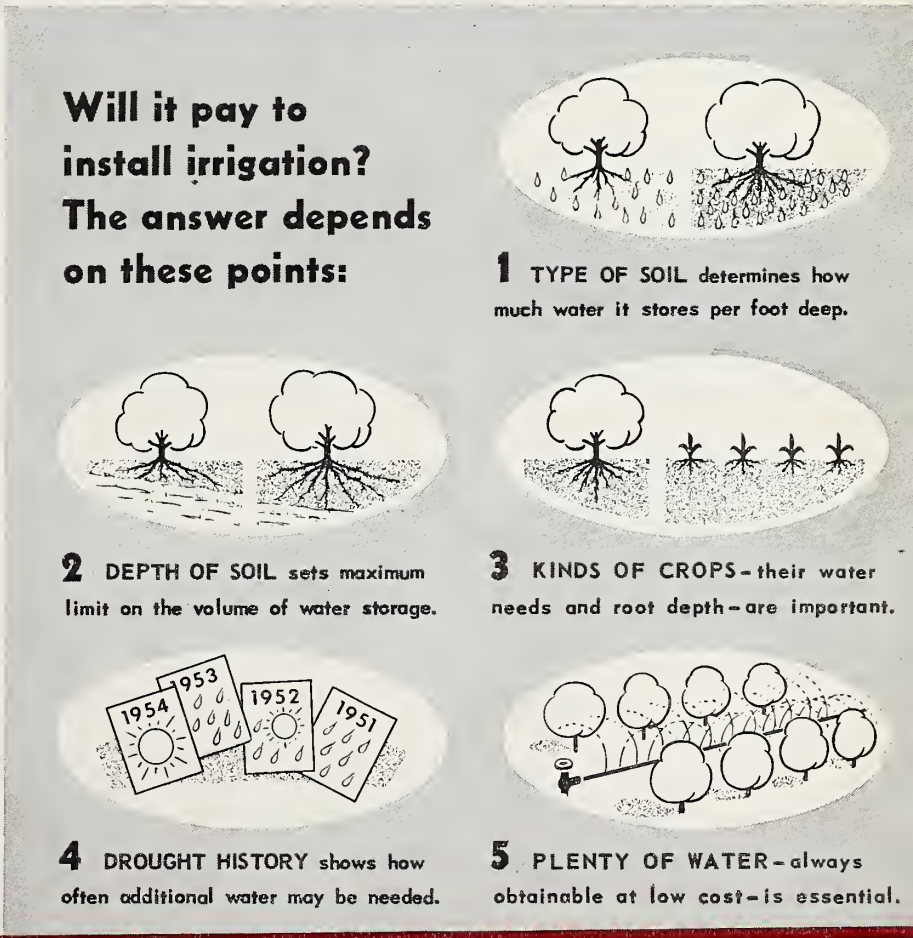
So long as water is being picked up at all depths of the root system, fruit grows at the optimum rate and irrigation won't speed it up. But if part of the root zone is exhausted of available water, fruit growth slows down, may ultimately stop. Restoring water starts growth again but doesn't make up for the loss.

Soil type is important. Sandy soils hold about ½ to ¾ inch of available water per foot of depth, silt loams 1½ inches or a little more, and heavy clays perhaps as much as 2½ inches of water per foot of soil depth.

Deep soils can store a considerable amount of usable water, shallow ones not so much. But some clay soils are so compact that tree roots don't penetrate them. In such soils, trees grow shallow-rooted and have only a limited reservoir of soil-stored water to draw on regardless of depth of the soil.

The kinds of crops grown, including nonfruits, may determine whether it will pay to invest in a supplemental irrigation system. Orchard fruits usually draw their moisture simultaneously at all levels of the root zone—perhaps to a depth of 15 feet in an open, well drained soil. But some shallow-rooted crops get all their moisture within the top few inches. A reservoir of 12 to 18 inches may be depleted by shallow-rooted crops in a short drought. And that might occur in some places nearly every year.

ARS horticulturist J. R. Magness, in charge of fruit and nut crops research, says that apples, pears, and pecans need about 4 inches of water a month from May through September—20 inches in total—to produce a full fruit crop. Peaches need about 4 inches a month for the 3 or 4 months leading up to harvest—possibly 16 inches in total. Apple fruits make nine-tenths of their growth, at a uniform rate, in the final 3½ months prior to harvest, but peaches make two-thirds of it in the final 4 or 5



weeks. Growth slowdown or stoppage in those periods really counts, especially in peaches.

Eastern soils generally are wet to field capacity as spring growth starts. Rate of use and timeliness of replacement are what count.

Study of an apple orchard on a shallow (18-inch) shale soil in western Maryland illustrates the point. Nineteen inches of rain fell from May through September one year. If well distributed, that's adequate. But at times, there was more rain than the ground could absorb. And in one 5-week period—July 3 to August 10—just 1 inch fell. That isn't enough. During this period, nonirrigated Rome Beauty apples grew only about half as fast as irrigated ones. When ground moisture was normal again, the nonirrigated apples grew just as fast—but never caught up. Yield ran 20 percent less.

The weather record is another valuable aid in judging the possible value of irrigation in any locality. A 25-year record of rainfall at Poughkeepsie, N. Y., shows that irrigation on 2½-foot silt-loam soil would have increased apple yield by 10 percent or more in 12 of those years. On 4-foot silt loams, irrigation would have increased yield significantly in only 3 of the years. The shallow soil could store about 4 inches of available water, whereas the deeper soil could store 7 inches. In 9 of the 12 droughty years, the extra depth of soil stored enough water to prevent a slowdown.

Magness says that pecans will draw moisture from about 15 feet in open, well drained soil. That's storage for 7 or 8 inches of water in sandy soil, 15 or 20 inches in silt loam. Weather records for the Southeastern Pecan Belt show that even the 10 driest years of the past 4 decades averaged 10 to 12 inches of rain during the growing season. This, added to a full ground supply when the season began, was ample for the crop nearly every year. There have been few seasons, like 1954, too dry for pecans. Even then, the best soils gave good crops.

To justify buying irrigation equipment, one must have an ample and dependable water supply close by. Magness believes an orchardist should have enough water, over the season, to cover his entire orchard with at least 4 inches of water for peaches and 6 inches for apples. He estimates the cost of portable equipment at $75 to $100 an acre. The cost of bringing in water is extra.

Using these guides and long-term weather records for the locality, an orchardist can judge whether an irrigation investment will pay.☆

PROPER RIPENING SAVES FLAVOR

■ Capturing stronger flavor in apple-juice products should widen the market for Northwest apples, say scientists working in Washington State to improve juice quality.

At present, the researchers point out, apples make up less than 5 percent of this country's canned fruit juice and "are not even an item" in our big frozen-concentrate industry. Yet, there's good juice in the large quantities of cull apples—the too-small fruit as well as larger fruit with some damage or defect.

Comparing juices made from four varieties of apples—standard Delicious, Golden Delicious, Jonathan, and Winesap—the researchers found wide differences in quality, depending on maturity and grade of fruit and the way it's handled. These tests were conducted by ARS chemists A. M. Neubert and G. H. Carter of the USDA Fruit and Vegetable Products Laboratory, Prosser, Wash., and horticulturist Archie Van Doren of the Washington State Tree Fruit Experiment Station, Wenatchee.

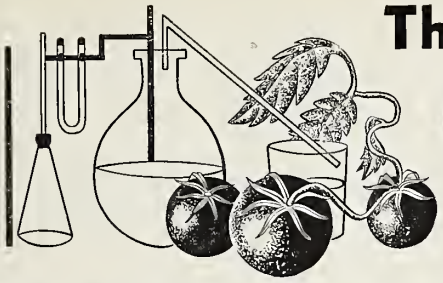
The most important thing a juice processor can do to improve flavor, the experiments indicate, is to ripen his apples to their best flavor stage after picking. Juice made from standard Delicious apples the day after harvest lack flavor and is astringent, even when the fruit has been picked at its best. In this variety, at least 2 weeks of post-harvest ripening are required to develop flavor. Ripening for as long as 6 weeks is advantageous if the fruit is picked before prime maturity.

The other three varieties are best for juice after 1 or 2 weeks of post-harvest ripening. Holding longer often weakens juice quality.

Because Delicious apples frequently predominate in Pacific-Northwest orchards, juice experiments have included blends with large proportions of Delicious and lesser amounts of tart varieties of varying ripeness.

The researchers suggest this procedure where Delicious is the major crop: pick poorly colored Jonathan and Winesap fruit early, *before* the fresh-market harvest, poorly colored Delicious applies late, *after* the harvest. More Delicious can be included in juice blends without flavor loss when the tart Jonathans and Winesaps used aren't fully ripe.

Studies are underway to determine the juice quality of apples now being delivered to plants. Findings should show (1) what changes in fruit-handling procedures would most improve juice and (2) problems such changes might bring.☆



The tomato's NEW career

THE TOMATO HAS HAD A VARIED CAREER. Beginning as a cherry-sized fruit growing wild in the Andes, it has been popular as an ornamental "love apple" and was thought to be poisonous as late as 1820. Today, the tomato ranks third among United States vegetable crops—can be served as vegetable, juice, soup, salad, or sauce. And now? It's starting a new career as an antibiotic and source of steroid hormones.

This latest phase of the tomato's versatility began when USDA scientists isolated from stems and leaves of tomato plants an antibiotic substance capable of inhibiting the growth of the *Fusarium* fungus that's responsible for common wilt disease in the tomato.

Named tomatin—now usually spelled tomatine—this antibiotic is found in all tomato plants not infected with the fungus. But tomatine content diminishes in infected wilt-susceptible plants as the disease develops, until the antibiotic can no longer be detected in fully wilted plants.

Further investigations showed that tomatine is effective in hindering the growth of certain fungi causing human and animal disease. It proved active against experimental cultures of fungi responsible for skin diseases and a number of serious internal ailments.

As a result, an Argentine pharmaceutical firm is now making tomatine commercially. A water-soluble ointment of 5-percent tomatine appeared highly effective in clinical treatment of fungus diseases of the skin. Usable in powder or lotion form as well, the drug is odorless and nonirritating. United States firms have shown considerable interest.

Research on the properties of tomatine at the ARS Eastern Regional Research Laboratory, Wyndmoor, Pa., has shown that chemical breakdown of this substance produces another compound, named *tomatidine.* Cooperative work with the National Institutes of Health, Bethesda, Md., soon revealed that tomatidine can be a starting source of cortisone and the steroid sex hormones progesterone and testosterone, and possibly other useful sterols. Previously, only three sterol sources were available: cholesterol (isolated from animal-nerve tissue), stigmasterol (obtained from soybeans), and diosgenin (extracted from Mexican yams).

Conditions for harvesting, drying, and processing tomato vines for tomatine have been investigated at the Eastern laboratory. Results of these studies show that commercial-scale production is possible.

Work on tomatidine's chemical makeup is essentially complete. In determining its structure, ARS and Public Health Service researchers have prepared 20 new related compounds, some of which may have physiological activity different from that of tomatidine. Several of these new compounds are being tested now, particularly with regard to activity in cardiovascular disorders. Tomatidine is a steroidal alkaloid and appears related to the veratrum alkaloids that are widely used to treat these disorders.☆

Readers' REACTIONS

Suggestion

SIR: I have read with considerable interest the article relating to sun-resistant cotton cloth used for shading tobacco (February 1955, p. 6).

I am wondering if you can give me the names of textile finishers who are marketing the cloth, as we would like to obtain some for our work with insects.—J. G. LEACH, Head and Professor of Plant Pathology, West Virginia University, Morgantown.

● Names were furnished by Dr. C. H. Fisher, Chief, Southern Utilization Research Branch, 2100 Robert E. Lee Boulevard, New Orleans 19, La.

Farm Advisor R. H. Sciaroni, University of California Extension Service, thought the cloth might be used for some 200 acres of clothhouse-grown chrysanthemums in San Mateo County. Others interested: G. L. Switzer, Assistant Professor of Forestry, Mississippi State College; and H. J. Carew, Professor of Vegetable Crops, Cornell University.—ED.

Permission

SIR: I am presuming that we RFD's have permission to quote from AGRICULTURAL RESEARCH Magazine.

It's almost a 24-hour-per-day job just trying to keep up with our changing agriculture, and if it weren't for folks like you who help to put the new stuff in readily available form, I'm sure that we RFD's would be further behind than we are.—CLIFF ALLEN, Radio Farm Director, Station WNOX, Knoxville, Tenn.

● Radio and television farm directors may use this material, and many are. Prints of photographs used with articles can usually be furnished for TV.—ED.

Transposition

In "How Times Have Changed" (March 1955, p. 8) we said under "SWINE":

"Average weights: pigs on 1953 ration, 200 lbs.; on 1930 ration, 103 lbs.; on 1910 ration, 105 lbs."

As you probably guessed from the picture, "103 lbs." should have read "130 lbs." for the 1930 ration.—ED.

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agrisearch notes

HOME GARDENERS will find the latest word on how to recognize and control common plant pests in the new USDA bulletin *Insects and Diseases of Vegetables in the Home Garden.*

From this handbook's numerous illustrations, the gardening amateur can identify some of the more common insect enemies and diseases of his vegetables. Detailed instructions for preparation and use of insecticides and fungicides are given. Other growers will also find the handbook helpful, though it doesn't discuss some insecticides recommended for use on large plantings.

Single copies will be available free from Office of Information, USDA, about July 1. Ask for Home and Garden Bulletin No. 46. (This supersedes Home and Garden Bulletin No. 23.)

CONCHO WINTER WHEAT, a new hard red variety for the central and southern Great Plains, looks like a coming replacement for standard varieties now grown in Oklahoma and adjacent States. Developed by agronomists of USDA and the Oklahoma experiment station, Concho has been released for seed increase to Oklahoma Foundation Seed Stocks, Inc., and the Kansas and Texas experiment stations. Seed for general planting should be available in a year or two.

Concho's milling and baking quality is generally equal or superior to other high-quality bread wheats popular in this area, including Comanche, Pawnee, Triumph, and others introduced in the past dozen years. Its yielding ability, high test weight per bushel, and resistance to certain diseases should make it attractive to many growers.

The new variety, medium early maturing, was produced by crossing Comanche with a wheat obtained from a cross of Blackhull and Hard Federation. The final cross from which Concho was selected was made in 1937 at the Southern Great Plains Field Station, Woodward, Okla.

In 6 years of comparative tests (1949–54), Concho outyielded Comanche and other recommended varieties in all sections of Oklahoma. Like other varieties grown in the area, it is susceptible to stem rust and hessian fly and has only moderate resistance to loose smut. But it is tolerant to yellow-streak mosaic, yielding about twice as well as other recommended varieties under controlled attack. Concho has also demonstrated superior resistance to leaf rust, bunt, and soil-borne mosaic disease—all serious threats in the southern Great Plains.

PINK BOLLWORM MOTHS are weak flyers—but they can soar for miles by hitchhiking on the wind. USDA scientists believe the moths' ability to ride air currents makes their spread across the Cotton Belt harder to control.

Since 1951, this tightly quarantined pest has moved into about 90 previously uninfested counties in Texas and nearby States—mostly by air, the scientists think.

They have good grounds for this belief. ARS entomologist P. A. Glick has trapped a dozen pink bollworm moths at altitudes of 100 to 1,000 feet in 37 flights over southern Texas. One of the highest-flying moths was caught over a desolate area of cactus, mesquite, and grass—15 miles from the nearest cotton field.

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